NATURAL DIET OF *CALLINECTES ORNATUS* (BRACHYURA: PORTUNIDAE) IN BERMUDA

Foregut contents of 56 specimens of *Callinectes ornatus* (8.8-51.8 mm carapace length) collected from Mullet Bay, Bermuda in 1981 and 1988 were examined. Foreguts which were ≥ half full (91.1%) contained more prey items per gut (X = 4.67) than did guts ≤ half full (X = 2.73). Dietary analysis was based on two methods; (1) the index of relative importance (IRI), which combined frequency of occurrence (FO), percentage of total biomass (GC), and percentage of total numbers consumed (NC), and (2) weighted points (PTS), which combined FO and estimated relative volumes of each prey item. No significant differences were revealed in relative proportions of foregut contents between males and females, or between adult and juvenile crabs.

This crab is an opportunistic predator of slowly moving benthic macroinvertebrates, specifically gastropod molluscs. Diet was related to prey availability. *Modulus modulus*, a cerithiacean gastropod that grazes algae and *Thalassia*, dominated the diet, accounted for 21.1% of the total IRI. Two other cerithiaceans collectively ranked second (19.9% of total IRI). All species were common in Mullet Bay. Carbonate substrate was the most frequently occurring category (51.79%) and ranked third in IRI (17.2% of total). While many studies of crustacean diet relegated such entities to a non-nutritional status, other papers documented the presence of diverse microscopic and meiobenthic organisms in coral sand substrates. Because the biomass can be relatively high in such substrates, they should be regarded as a potentially important food source, and considered part of the diet. Plant material, crustaceans, nereid polychaetes, fish, and bivalve molluscs ranked fourth through eighth in IRI. The PTS index is better suited for foods consisting of a high proportion of soft tissue; FO is appropriate for most foods, but tends to elevate the importance of unidentifiable material, sand, and small animals occurring frequently, but in small amounts. Errors due to accumulation of material that is digested or cleared slowly occurs in both methods. While no one quantitative method is ideal for assessment of dietary analysis in brachyurans, the IRI value has a great deal of merit. Because IRI is based on three other indexes, it is possible to determine the relative impact that each component index has on the total IRI for the dietary items, and because the PTS method has been widely accepted, it is recommended that future dietary studies of brachyurans be designed to incorporate all indexes.

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THE LIFE HISTORIES OF THE TASMANIAN FRESHWATER CRAYFISHES OF THE GENUS *ASTACOPSIS* (DECAPODA: PARASTACIDAE)

The life histories of the two poorly understood members of the Tasmanian endemic freshwater crayfish genus *Astacopsis* were studied in their natural habitats. *A. gouldi*, the world's largest freshwater crayfish, and therefore freshwater crustacean, is capable of reaching very large size (3 to 4 kg) and is restricted to the rivers of the north of Tasmania while the smaller *A. franklinii* (up to 1 kg) is widespread in rivers and lakes throughout the state (Swain *et al.*, 1982). Both species are generally associated with swift and cool riverine or highland lacustrine habitats.

Male and female seasonal reproductive and moulting cycles, mating, spawning and larval development, were investigated through intensive monthly sampling and mark-recapture programme from September 1985 to May 1987 (Hamr, 1990). A portion of each catch was preserved for subsequent gonad analysis in the laboratory.

Results

Mature females of *A. gouldi* mate and spawn in April–May, eggs are carried over winter, hatch in January, and young stay attached until late into the following summer (March–April). After the release of their broods females overwinter, then moult in mid-summer (January–February) and mate and spawn again in autumn, two years after their previous mating. Similarly, *A. franklinii* mate and spawn in April–May, eggs are carried over winter, hatch in January, and young stay attached until well into the following autumn (April–May). Adult females of *Astacopsis* therefore exhibit a biennial breeding and moulting cycle. This strategy results in two distinct female reproductive groups: 1. reproductive, or those moulting, mating and spawning in a given summer and, 2. non-reproductive, or those incubating young and larvae in a given summer. These two groups can be easily separated on the basis of ovary development, presence of eggs or young, moult stage and the condition of secondary sexual characters such as glair glands and gonopore and pleopodal setation. Representatives of the two reproductive groups occurred in collections throughout the duration of the study. In males of both species, sperm was found within the vasa deferentia from February to May. Sperm tubes began forming in February, their number peaking in early May and then decreasing through the winter. Unlike females, males appear to breed every year. The gonads of reproducing females and males therefore show synchronous cyclic development with peak development occurring just prior to the mating season. The postembryonic development in *Astacopsis* consists of four morphologically distinct larval stages and appears to be significantly different from other parastacids as well as astacids/cambarids. The development sequence is considered to be primitive in having retained some of the ancestral marine larval characters in particular the four developmental stages, and early differentiation of swimming appendages in the form of a tail fan.

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